Tufts University

Chair,
Faculty Search Committee,
Department of Physics, Box 351560,
University of Washington,
Seattle WA 98195-1560

Fermilab, October 26, 2004

Object: Application for Faculty Position in Experimental Physics and Research Plan

Dear Search Committee Chair,

I am applying for the faculty position in Experimental Physics.
At the present I am a Senior Research Associate at Tufts University, working for the CDF experiment at Fermilab and the ATLAS experiment at CERN.
Before presenting my research plan, I would like to introduce myself and briefly summarize my past experience.

I started my scientific career as a phenomenologist, working on issues related to fragmentation phenomena in perturbative QCD. After my graduation at University of Pavia, Italy, in 1995, under the supervision of Professor Mario Greco, I joined the CDF experiment as visiting scientist at Lawrence Berkeley Laboratory, with a fellowship from Collegio Ghislieri, Pavia. I worked in the framework of the top analysis, on aspects related to the systematic uncertainties present in the determination of the top mass.

In 1997, I joined the Tufts University CDF group and since then I have been involved in several software projects in two HEP experiment: CDF and ATLAS.

In 1997-98 I worked on a proposal for a data handling system based on an Object Oriented (OO) database (Objectivity/DB) for CDF. A prototype database system was built to transfer Run I CDF

data and make them accessible via OO visualization/analysis tools. This experience allowed me to get extensively familiar with C++ and object oriented analysis and design. I kept working on issues related to OO database performances in the framework of the ATLAS offline group and MONARC collaboration at CERN.

In 1999 I was appointed leader of the trigger simulation project at CDF. The CDF experiment has a three level trigger system, two of which (L1/L2) are hardware trigger systems. The trigger simulation is a set of several C++ software simulation/emulation packages for L1/L2; they are used as an offline tool to calculate rates and efficiencies and as an online monitoring tool, during data taking as one of the monitors running in the control room. I wrote the complete software for two of the packages (Calorimeter Trigger and Muon Trigger) while I provided the necessary framework - infrastructure, Trigger DB access, et cetera - for other developers (mainly physicists with no software expertise) to write code specific for their system (track trigger and silicon trigger). The project was successfully completed in time for the beginning of Run II data taking.
I am currently responsible for ensuring that all the packages are kept up to date in respect to software development (i.e. software releases), that the executable TRGSim++ is available to all CDF users on a daily basis, and that every change in the hardware is reflected in the emulation software.

In 2001, I started working on a simple ntuple representation of the CDF event information.
CDF adopted ROOT as its data underlying persistency mechanism, however the details of it are hidden under an intermediate layer (EDM or Event Data Model) accessible via Application Modules of AC++, the analysis framework.
Our idea was to allow for a quick translation of the data into a flat ROOT Tree, via a standard set of "ntuplizers" for the various objects contained in the CDF event. This allowed us to be decoupled from the framework for all the type of analysis not requiring the use of reconstruction modules, while at the same time maintaining a one-to-one correspondence with the event content.
eN or evtNtuple is now one of the 3 major analysis tools in CDF, and I am the librarian for it.

From 1998 to 2000, I served as convener of a subgroup of the Exotic Physics group, aimed at defining triggers and datasets for exotic searches at Run II (Exotic Triggers and Datasets).
In the meantime, I carried out a Run I analysis aimed at searching for the supersymmetric partner of the bottom quark, produced from the decay of gluinos, in collaboration with the Padova/INFN CDF group.

In the Fall of 2000, together with Young Kee Kim, Nigel Lockyer and Avi Yagil, I initiated a group aimed at bringing together students and young postdocs to learn the necessary skills for doing analysis in CDF with the Run II data. Indeed, due to long hiatus between Run I and Run II we were realizing that many young people were unprepared for doing analysis, lacking the ability of putting all the pieces necessary to producing a final result together.
Initially we worked closely with a small group of students and postdocs who were relatively new to CDF. We helped them understand the basic detector configuration and the parameters for calorimeter, tracking, electrons, muons (the group was named Low Level Subjects or LLS).
We then educated each other about Run II software (simulation and reconstruction) and helped the offline group and the operations group providing feedback to them when data or simulation variables did not make sense, recruiting people to be part of the simulation/reconstruction group,

comparing the Level-3 (online) and production output and exercising the data handling system. The group grew bigger with over 50 people in the mailing list, as of May 2001. Most of the initial high P_T physics results produced by CDF originated from this group.

From January 2001 to December 2002 I was convener of the Exotic Physics group itself, at a time where CDF was setting the stage for run II analysis. The Exotic group comprises at least half of the CDF collaboration. Again, given the fact that we were at the beginning of a new phase of data taking, there was the need to focus the effort of the members of the group. Following the experience of working in the LLS group, I decided to create a subgroup of the Exotic group, aimed at bringing together senior physicists and the young students and postdocs already actively involved in producing physics results to exchange information, compare tools and provide feedback to each other.
The VEGY group (so called for Very Exotic Group) produced in March 2003 numerous results that were presented at the Winter Conferences, already superseding the Run I results: limits on new particles searches in the dijet mass spectra, dilepton mass spectra, CHAMPS, Leptoquarks and extra vector bosons.

Finally I became actively involved in physics analysis, working on searches for Leptoquarks (LQ). In 2003 I concluded the two analyses aimed at searches for first generation LQ and in Summer 2003 Daniel Ryan, a Tufts graduate student, whom I followed in his analysis work on searches for second generation LQ, joined me. Daniel completed his work in 13 months, blessed two analyses and defended his thesis in August 2004.
We are currently writing two PRL's and are in the final process of internal review on the part of the collaboration.
In the last few years I have been supervising several Italian summer students at Fermilab, who in general continued working toward obtaining a degree in particle physics.
At the present time I'm supervising another Tufts student toward his thesis project.

My scientific path has been quite diversified. I was given the opportunity to move relatively smoothly from my theoretical origins to more technical (software) aspects of an experimental reality like CDF. This gave me the possibility of keeping a unified view of high-energy physics since my expertise goes from the theoretical foundations of physics to technical aspects of a HEP experiment. I'm very interested in transmitting this type of vision to the new generations of students. In the past years I have demonstrated very good leadership skills as well as the ability to work in a team and attract younger people to the field.
I will now describe in details my research plan.

My current research interest is focused on CDF and on longer term on the LHC experiments, in particular ATLAS. I consider these experiments (as well as DZero and CMS) to be the best in the next decade in hadron collider physics and I believe they offer a wide potential for physics discovery.
In the framework of a 5-years plan, I would like to commit to both a TeVatron experiment and LHC one. Given the involvement of your department in DZero, I would like to devote some time to data analysis there and work on ATLAS final construction and commissioning.

Although the final luminosity that can be reached in Run II has been sizably reduced (with a negative impact on the potential of discovering the Higgs boson, for example) the new features of the detector are still very useful for other analysis aimed at searches for new phenomena.
I believe it is important to maintain an active role in a TeVatron experiment in the next two to four years in order to assure that physics results can be extracted from the Run II data and publication in physics journals could be reached.
As for research topics, I am interested in exploiting the capability of tagging events enriched in heavy flavors at the trigger level for searches for third generation exotic particles. Also, given the experience gained with the leptoquark analysis in signatures involving leptons, I'm interested to carry on searches for Supersymmetry in channels involving leptons, jets and missing energy.

While the activity in a TeVatron experiment ensure access to real data and the possibility of producing physics publications in the short term, the LHC experiments are the places where new phenomena can be observed in the mid term future, beyond what it is possible to observe with CDF or DZero from now to 2007.
In a five years plan (2005-2010) it is then very important, in my opinion, to work on being ready for physics analysis as soon as the commissioning phase of the ATLAS detector will be completed. Between 2005 and 2010 ATLAS and CMS will go through final construction and commissioning of the detectors and the first physics results could be published around 2009. With this perspective in mind, I would start working full time on LHC around 2008.
As a current member of ATLAS, I would be glad to join your group and follow on its current activities. I'm already part of the muon collaboration, as Tufts is in the Boston Muon Consortium. Recently I became active on test beam analysis and MDT chamber certification.
As for physics analysis, my main interest is in looking for the Higgs boson and searches for new phenomena. The exact scope of the physics interest will be of course shaped in the course of the TeVatron Run II, as most of the results obtained by CDF and DZero will be the starting point for LHC analysis strategies. The experience accumulated in CDF/DZero will be of course very useful at LHC.
Finally, I'm looking forward to the opportunity of working with undergraduate and graduate students and I hope to be able to share my enthusiasm for physics and actively get them involved in the research topics I'll be working on. Given my diversified background I try to keep a broader view on physics, which is at times challenging as our field is becoming more and more specialized. I hope to transmit this attitude to the younger people working with me.
I feel I can contribute significantly to the scope of your Department and I'm looking forward to meet with you and the search committee.

With Best Regards,
Simona Rolli

Simona Rolli
Fermilab, MS 223, PO BOX 500
Batavia, IL, 60510, USA
630 840 2639
rolli@fnal.gov

Letters of Reference will be sent separately by:

Prof. Young Kee Kim,
Department of Physics
The University of Chicago and the Enrico Fermi Institute
5640 S. Ellis Ave. Chicago, IL 60637
Phone: (630) 840 3384
e-mail: ykkim@fnal.gov or ykkim@hep.uchicago.edu

Prof. Luciano Ristori,
Istituto Nazionale di Fisica Nucleare
Pisa, Italy
MS 223 - Fermilab
PO Box 500, Batavia, IL 60510
Phone: 630 840 8612
e-mail: luciano@fnal.gov

Prof. Krzysztof Sliwa,
Tufts University
4 Colby St, Medford, MA 02155
Phone 617 627 3332
e-mail ksliwa@tufts.edu

Prof. Giorgio Bellettini,
University of Pisa, Italy
Fermilab, MS 223,
PO BOX 500, Batavia, IL 60510
Phone 630 840 2635
e-mail giorgiob@fnal.gov